

BOTRYTIS DEVELOPS RESISTANCE TO FUNGICIDES USED IN BULB CROPS

Multiple applications of fungicides are commonly used by tulip, lily, and daffodil growers to control diseases caused by various species of *Botrytis*. Grower's reports indicated loss of disease control where Benlate and Chipco-26019 were being used in both greenhouse and in field situations. Historically, it has been fairly common to have *Botrytis* species develop resistance to Benlate. However, loss of disease control does not necessarily mean resistance has developed. It is first necessary to isolate the fungus and conduct laboratory tests to demonstrate that resistant isolates are present. Loss of disease control could also be the result of several other factors, including improper mixing, inadequate coverage, deactivated material, etc.

Laboratory tests confirmed the presence of fungicide-resistant *Botrytis* strains in both Washington and Oregon. Samples were obtained from both field- and greenhouse-grown lilies (*Botrytis elliptica* and *Botrytis cinerea*), field- and greenhouse-grown tulips (*Botrytis Tulipae* and *B. cinerea*), field-grown peony (*B. cinerea*), and greenhouse-grown iris (*B. cinerea*).

Forty-three to eighty-seven percent of the *B. elliptica* and *B. cinerea* isolates were resistant to both Benlate and Chipco-26019, while isolates of *B. tulipae* were only resistant to Benlate. Resistance was more prevalent in the greenhouse-grown plants than in the field-grown plants. Reasons for this have not yet been determined.

Because of their chemical nature certain fungicides and fungicide groups are more prone to resistance problems, and these are commonly referred to as "at risk" fungicides. When resistance has been detected, growers will have to use other registered fungicides for control. The possibility of cross-resistance will have to be considered when choosing an alternative fungicide. Strains of fungi will commonly be resistant to an entire group of related fungicides; this phenomenon is called cross-resistance. Thus, strains resistant to Benlate would also be resistant to the other benzimidazole fungicides - Topsin-M, Topsin and Mertect. Likewise, strains resistant to Chipco-26019 will also be resistant to the other dicarboximide fungicides - Ornalin, Ronilan, and Rovral. In fields or greenhouses where *Botrytis* isolates were found to be resistant to both Benlate and Chipco-26019, none of the above fungicides would be expected to give control.

In fields and greenhouses where resistance has not yet developed, repeated applications of these "at risk" fungicides should be avoided. Alternating or making tank mixtures with other effective fungicides is suggested. Because of cross-resistance (see above), alternating or tank mixtures of related compounds will not reduce the potential for resistance and should be avoided. Alternating

applications of Chipco-26019 and Ornalin, for example, would **not** be effective in reducing the potential for resistance to develop.

Alternation does not imply a regimented schedule. For example, on tulips a Benlate application could begin the season, followed by several applications of Daconil-2787 and then Chipco-26019 once or twice prior to harvesting the blossoms.

With proper management, these highly effective "at risk" fungicide materials can remain in the grower's arsenal of usable products.

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